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RECORD OF DECISION

WATKINS-JOHNSON SUPERFUND SITE
SCOTTS VALLEY, CALIFORNIA

RECORD OF DECISION
DECLARATION STATEMENT

SITE NAME AND LOCATION

Watkins-Johnson Superfund Site
Scotts Valley, California

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Watkins-Johnson Superfund site located in Scotts Valley, California, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §9601, (CERCLA) and, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300, 55 Fed. Reg. 8666 (NCP). This decision is based on the administrative record for this site.

The State of California has no objection to the technical aspect of the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The selected remedy for the Watkins-Johnson site addresses groundwater contamination, in which trichloroethylene is the primary contaminant of concern. Other contaminants detected in groundwater at concentrations exceeding the selected treatment standards include vinyl chloride, tetrachloroethylene, 1,1-dichloroethylene, 1,1-dichloroethane, 1,4-dichlorobenzene, cis-1,2-dichloroethylene, and silver. The selected remedy also addresses an area of soil contaminated with volatile organic chemicals including 1,1-dichloroethylene, cis-1,2-dichloroethylene, tetrachloroethylene, methylene chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethylene and chloroform.

This action represents the final remedial action to remove contaminants from groundwater and soil. Several response measures were previously performed at the site by Watkins-Johnson. The major components of the selected remedy will:

- Prevent off-site migration of contaminants within the perched zone by using infiltration leachfields (also referred to as perched zone recharge galleries). Currently one infiltration leachfield is operating on-site;
- Transfer contaminated groundwater within the perched zone to the regional zone for more efficient extraction by means of gravity drains, five of which are currently operating on-site;
- Capture and extract contaminated groundwater within the regional zone by using extraction wells, four of which are currently operating on-site;
- Treat extracted groundwater by using an existing granular activated carbon adsorption system;
- Remove soil contamination from the vadose zone by using a soil vapor extraction system; and
- Minimize the potential for mobilization of soil contamination into the groundwater by installing an impermeable cap over the area of concern.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable for this site, and satisfies the statutory preference for selecting remedies that employ treatment as a principal element that significantly and permanently reduces the toxicity, mobility, or volume of the hazardous substances.

The remedial action for treatment of groundwater is expected to take approximately ten years to complete. A review of the remedial action will be conducted every five years after commencement to ensure that the remedy continues to provide protection of public health and the environment.

6·29·90
Date

Daniel W. McGovern
Daniel W. McGovern
Regional Administrator
EPA Region IX

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DECISION SUMMARY

I. SITE DESCRIPTION

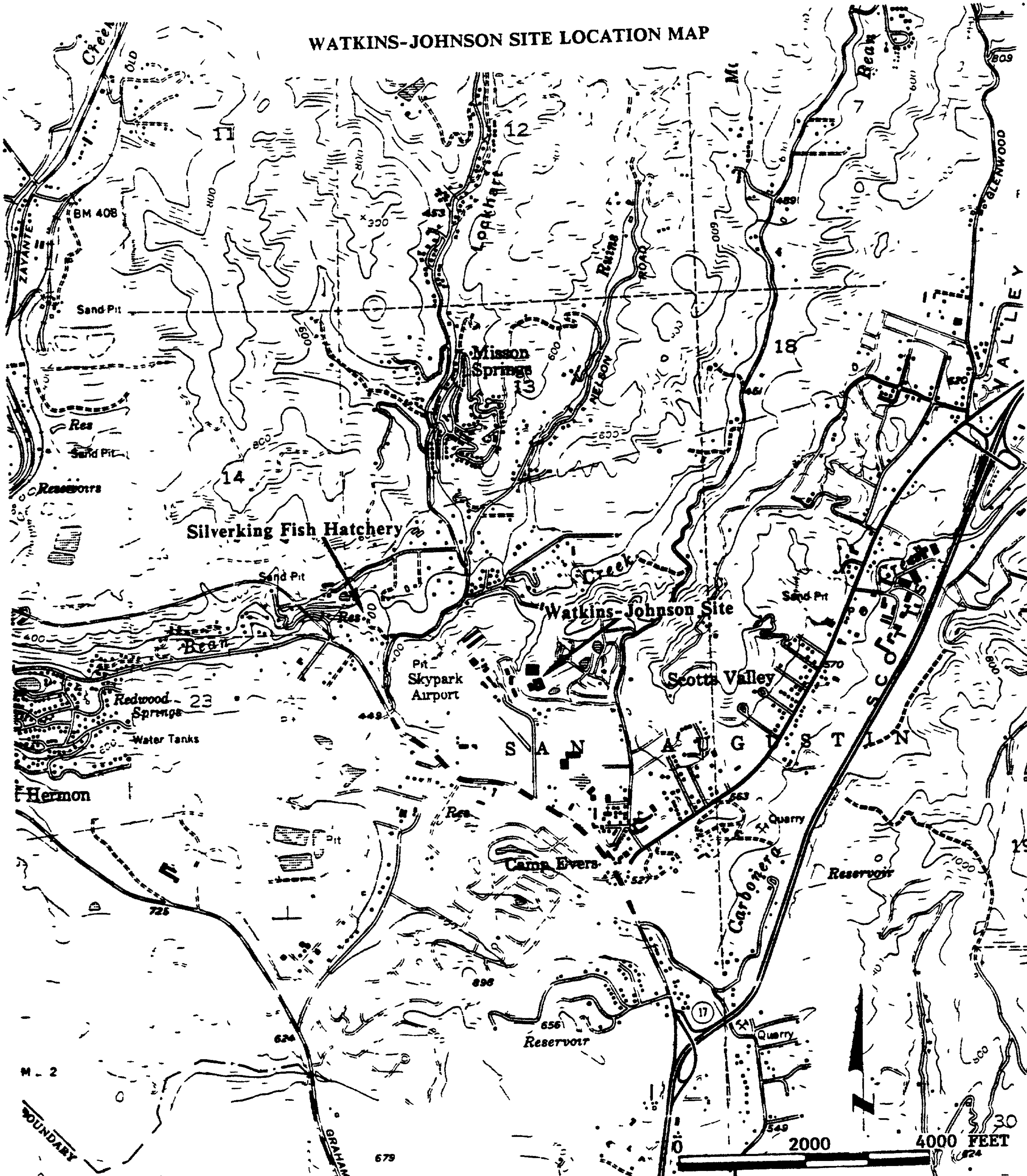
The Watkins-Johnson Superfund site (the site) is located in Santa Cruz County, approximately 5 miles north of the City of Santa Cruz, in a small valley located west of the city of Scotts Valley, east of Sky Park Airport, and southwest of the Santa Cruz Mountains (Figure 1). This area is considered to be within the California Coast Range and is in close proximity to California's Pacific coastal zone.

The elevation at the Watkins-Johnson site is approximately 460 feet above mean sea level (MSL). The area north of the site is comprised of forested mountains that are incised by numerous stream channels. Surface elevations within this mountainous area range from 400 to 1,200 feet above MSL. The area south of the site is comprised predominantly of rolling grassy hills with surface elevations ranging from 560 to 800 feet above MSL.

Several creeks drain the region. These include Bean Creek, Carbonera Creek, Lockhart Gulch, Ruins Creek, and Zayante Creek. Bean Creek, a tributary to Zayante Creek, crosses north of the site and roughly divides the major aquifer, the Santa Margarita, into northern and southern portions. Both Zayante and Carbonera Creeks drain into the San Lorenzo River, which is west of the site. The San Lorenzo River flows southward and eventually enters the Pacific Ocean at Monterey Bay.

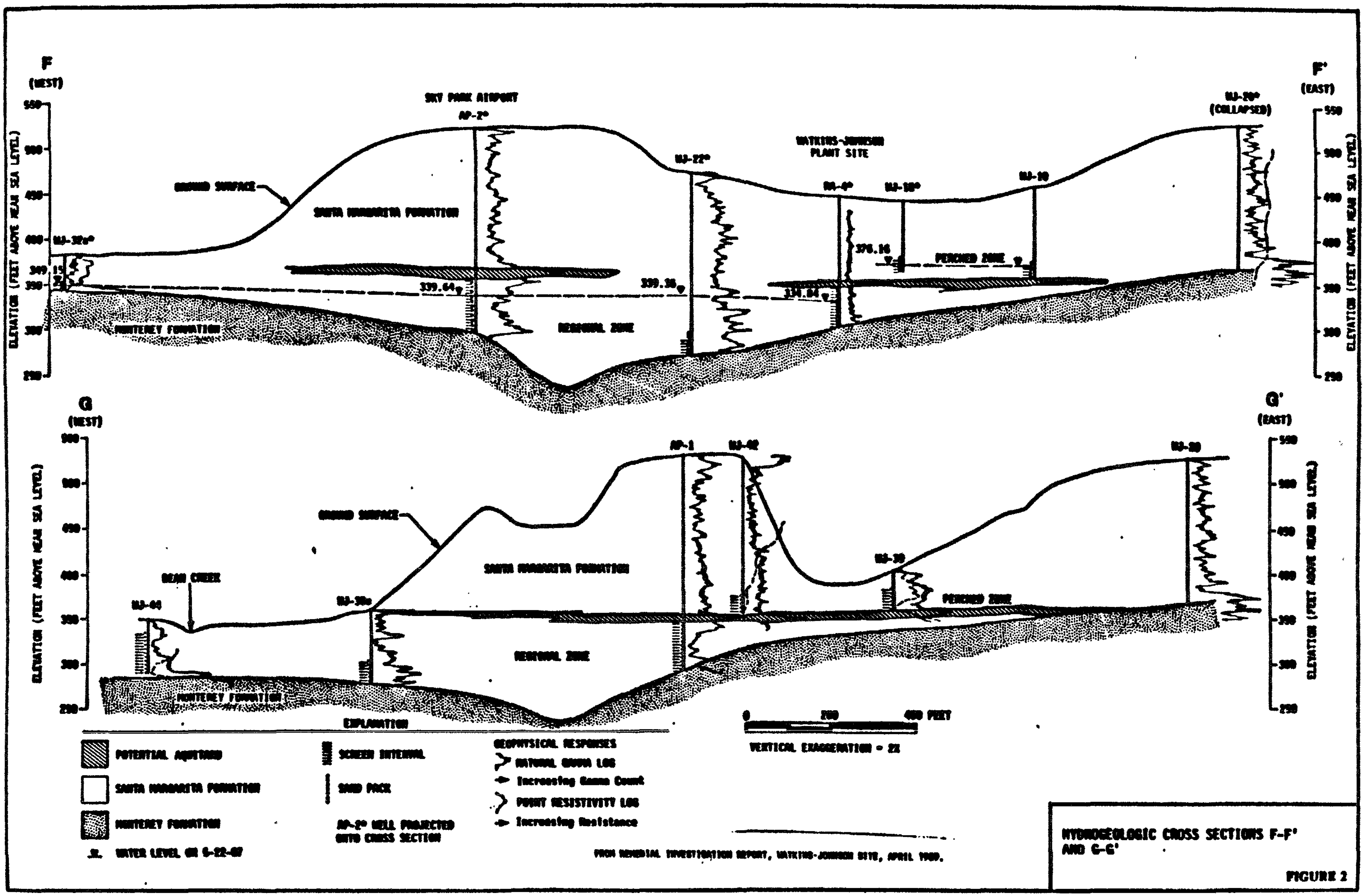
The Santa Margarita aquifer which underlies the site, is a major source of groundwater for the Camp Evers, Scotts Valley, and Mission Springs areas. EPA designated the Santa Margarita aquifer as a sole source aquifer, used for drinking water. In the Scotts Valley area, the aquifer is unconfined, and the Santa Margarita Formation crops out over much of the land surface. In the immediate vicinity of the Watkins-Johnson site, the Santa Margarita aquifer is comprised of a perched zone in addition to the regional zone (Figure 2). The perched zone is elevated about 35 feet above the regional zone. The aquitard which supports the perched groundwater and separates the two zones is a moderately cemented conglomerate. The aquifer is accessible for development of drinking water supplies and for contamination by chemicals migrating from the ground surface.

WATKINS-JOHNSON SITE LOCATION MAP



From U.S.G.S. 7 1/2 Minute Quadrangle, Felton, California

FIGURE 1



HYDROGEOLOGIC CROSS SECTIONS F-F' AND G-G'

FIGURE 2

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Watkins-Johnson Company (Watkins-Johnson) is the current owner and operator of the site and has been the owner and operator since 1963. Manufacturing at the site began in 1960. Watkins-Johnson has performed research and development, manufacturing, and industrial activities at the site. Industrial activities performed by Watkins-Johnson at the site include metal machining, degreasing operations, metal plating, glass cleaning, glass etching, welding, soldering, painting, and photo laboratory activities. Watkins-Johnson has used a variety of organic or carbon containing chemicals, inorganic or mineral acids, and metals at the site.

In 1984, the Regional Water Quality Control Board (the Regional Board), inspected the site and found the industrial chemicals trichloroethylene (TCE) and 1,1,2-trichloroethane (TCA) in the Watkins-Johnson wastewater disposal system. TCE had been used at Watkins-Johnson as an industrial solvent. Further investigations showed the presence of TCE and trans-1,2-dichloroethylene (1,2-DCE), plus minute quantities of TCA, perchloroethylene (PCE), and freon 113 in groundwater under the site.

In 1984, at the direction of the Regional Board, Watkins-Johnson began conducting an investigation of the nature and extent of contamination at the facility. On January 22, 1987, the Watkins-Johnson site was proposed for inclusion on the Environmental Protection Agency's (EPA's) National Priorities List (NPL). On June 18, 1987, Watkins-Johnson received an EPA Special Notice letter to begin RI/FS negotiations. On September 21, 1987, Watkins-Johnson signed an Administrative Order on Consent with EPA to conduct a Remedial Investigation/Feasibility Study (RI/FS). Watkins-Johnson submitted the final draft of the RI report in April 1989 and the final draft of the FS report in November 1989.

III. COMMUNITY PARTICIPATION ACTIVITIES

EPA has maintained three information repositories containing the Community Relations Plan, RI/FS Reports, technical documents, fact sheets, and other reference material. These repositories are located at the Scotts Valley Branch of the Santa Cruz Public Library, the Scotts Valley Water District Office, and the Scotts Valley Wastewater Division Office. In addition, the entire Administrative Record is available at the Scotts Valley Branch Library. The availability of these documents, as well as the announcement of a public comment period extending from February 14, 1990 until April 14, 1990 was published in the Santa Cruz Sentinel on February 7, 1990 and in the Scotts Valley Banner on February 14, 1990.

On February 28, 1990, EPA representatives briefed members of the Scotts Valley Town Council on the Proposed Plan for remediation of the site. In addition, a public meeting was held on March 7, 1990, at which EPA representatives presented the Proposed Plan for the site and answered questions. A response to comments received during the public comment period is included in the Response Summary, which is part of this Record of Decision (ROD).

IV. SCOPE AND ROLE OF RESPONSE ACTION

The response action at the Watkins-Johnson site consists of a remedy of contaminated groundwater within the perched and regional zones, and a remedy of soil contamination within the vadose zone. Recognizing the inherent link between the perched and regional zones, as well as the fact that the objective of a soil remedy is to prevent further leaching of contaminants to the groundwater, EPA has elected to treat the groundwater and soil components as a single remedial action.

During the course of the RI/FS, several response measures were undertaken consistent with this final remedial action. These included the following activities and were overseen by the Regional Board:

- o Use of the Building 8 leachfield (Figure 3) to deter the northerly migration of contamination within the perched zone. Since approximately June 1988, about 15 gpm of treated water has been injected into the Building 8 leachfield to create a groundwater mound that existed during past recharge operations to control the migration of the contaminant plume.

- o Installation of four extraction wells to intercept and capture the contamination within the regional zone. Aquifer restoration pumping of the regional zone commenced in October 1986, resulting in the formation of a cone-of-depression. The pumping rate was reduced from 325 gpm to about 250 gpm on April 27, 1987.

- o Removal of a contaminated dilution tank in the vicinity of Building 6 (Figure 3) and excavation, to a depth of ten feet, of surrounding contaminated soils.

The principal threat posed by this site is from contamination of groundwater that is or may be used for drinking water. To the extent the soil remains undisturbed with direct exposure prevented, no health-based risks have been identified for existing on-site soil contamination. However, on-site construction or disturbance of paved areas may disturb contaminated soils, exposing workers and posing a potential future risk to any population using the perched or regional aquifers for a domestic water supply.

The selected remedy addresses the principal threat by capturing and removing contaminated groundwater and treating it to health-based levels. Soils are to be remedied to a level that no longer poses a threat to groundwater quality. In the interim, the selected remedy also includes a means of reducing the potential for soil contamination to be mobilized. Contaminants removed from both soils and groundwater are to be captured and permanently destroyed, significantly reducing the toxicity, mobility or volume of the hazardous substances in both media.

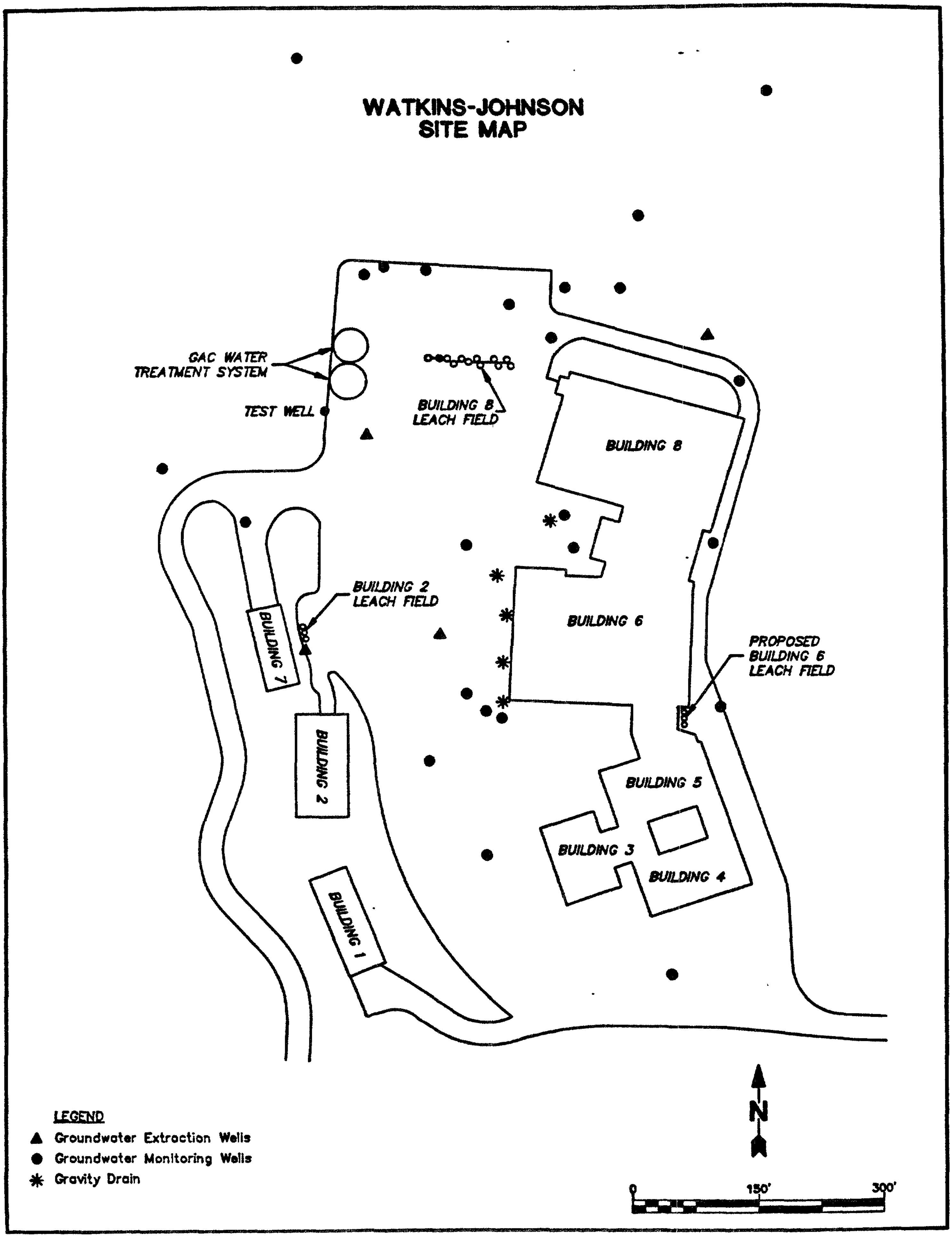

WATKINS-JOHNSON
SITE MAP
GAC WATER
TREATMENT SYSTEM
TEST WELL
BUILDING 8
LEACH FIELD
BUILDING 8
BUILDING 2
LEACH FIELD
BUILDING 7
BUILDING 6
PROPOSED
BUILDING 6
LEACH FIELD
BUILDING 2
BUILDING 5
BUILDING 3
BUILDING 4
BUILDING 1
LEGEND
Groundwater Extraction Wells
Groundwater Monitoring Wells
Gravity Drain
N
0
150'
300'

FIGURE 3

V. SUMMARY OF SITE CHARACTERISTICS

As part of the Remedial Investigation, a soil investigation was conducted to determine the degree and extent of contamination in the vadose zone. The soil investigation yielded the following conclusions:

- o The major concentrations of organic and inorganic contaminants are extremely limited spatially and are not frequently encountered. Table 1 summarizes the major organic and inorganic compounds detected in on-site soils.

- o The main concern regarding organic contamination remaining in the soil is continued leaching of contaminants to groundwater thereby increasing the duration of aquifer restoration activities.

A hydrogeologic investigation was also conducted as part of the Remedial Investigation. The monitoring program consisted of 30 wells screened in the perched zone, 42 wells screened in the regional zone of the Santa Margarita formation and 3 wells screened in the Monterey formation which underlies the Santa Margarita. Surface water samples from Bean Creek were also analyzed. The hydrogeologic investigation yielded the following conclusions:

- o The intraformational aquitard supporting the perched zone is a dense, moderately cemented, very poorly sorted conglomerate composed of well-rounded gravel, sand, and fine material. Where the aquitard exists, its thickness varies from a few feet to as much as ten feet. However, it appears that this aquitard is not continuous, and areas where the aquitard is not present have been identified. The discontinuities or stratigraphic holes are areas where groundwater in the perched zone may leak down into the regional zone.

- o The saturated thickness of the regional zone of the Santa Margarita formation is controlled by bedrock topography of the underlying Monterey Formation and the water-table surface. As a result of relief along the Monterey surface, the regional zone, beneath the site, varies in thickness from 40 to 60 feet, and is unsaturated overlying the subsurface Monterey highs.

- o The general groundwater flow direction in the perched zone is to the north. The saturated thickness of perched zone varies from less that 1 foot to greater than 15 feet in the area of the mound. The direction of groundwater flow within the regional zone is to the northwest toward Bean Creek. The water table is affected by seasonal fluctuations and by pumping in localized areas.

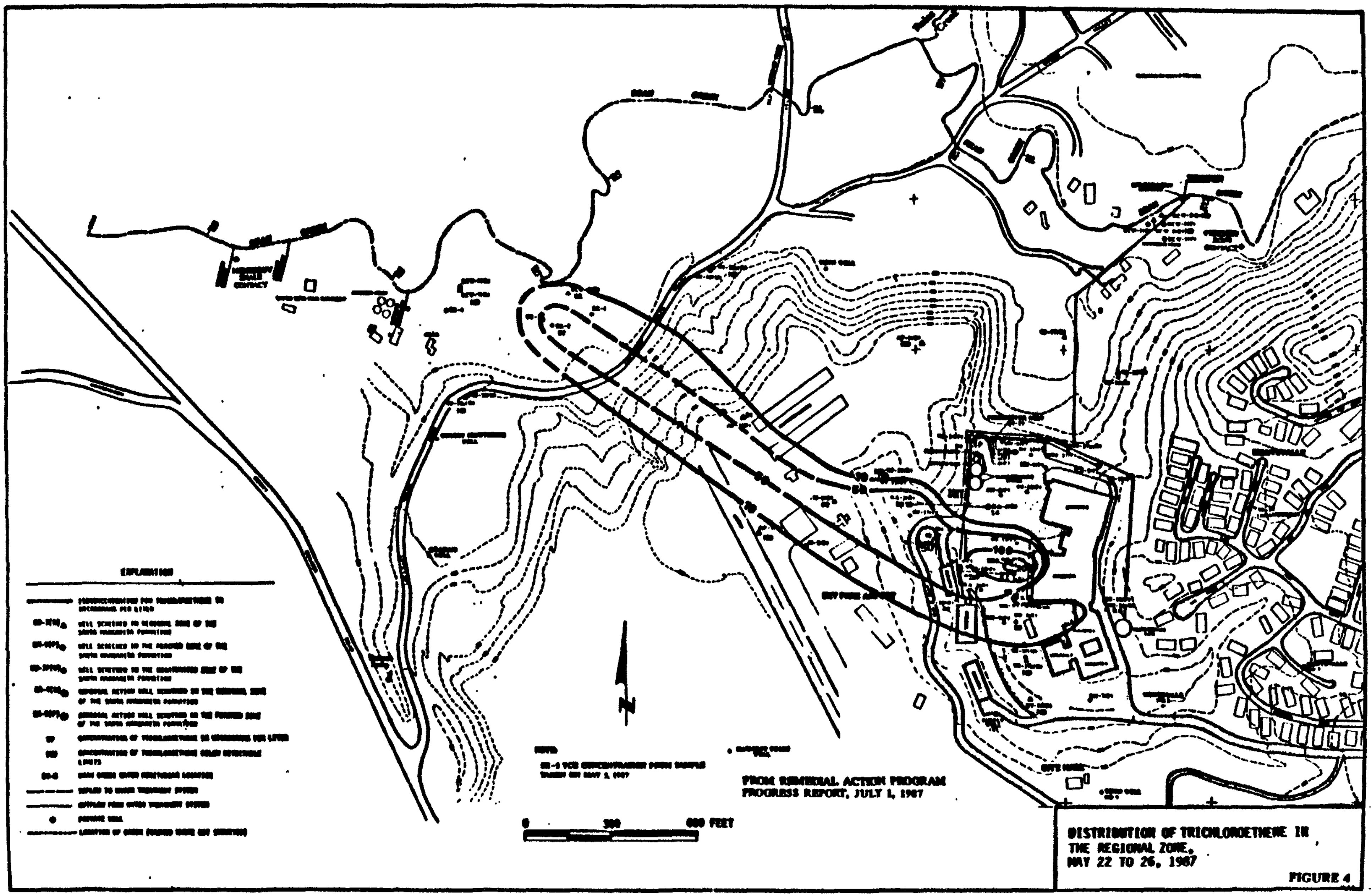
- TCE is the major contaminant of concern in the perched zone. The area consistently containing the highest concentrations is near the former Building 6 dilution tank. TCE values analyzed from groundwater samples in this area range from 34 to 13,000 ug/l. In addition to TCE, 1,1-dichloroethylene (1,1-DCE) and vinyl chloride are constituents of interest for the perched zone (Table 1). Detection of 1,1-DCE in concentrations equal to or greater than 2 ug/l was limited to test wells on the edge of the TCE plume. Vinyl chloride was detected in three wells in September 1988.

- TCE was the major contaminant detected in the regional zone together with lesser concentrations of 1,1,1-trichloroethane (1,1,1-TCA), 1,2-DCE, and 1,1-DCE (Table 1). The concentrations of TCE formed a narrow cigar-shaped plume which extended to the northwest, to Bean Creek in May 1987 (Figure 4). The highest concentrations of TCE were north of the Building 6 dilution tank area. Data collected since the initiation of aquifer restoration indicate that the contaminant plume, within the regional zone, has steadily diminished and is now contained almost entirely within the plant area (Figure 5).

- Six private wells have been found north of the Watkins-Johnson site that are considered potential receptors. These wells are located downgradient from the site in the generally northward flow path of the perched zone. However, not only has the TCE distribution, which is limited to the plant area, not changed in extent over time, but the present aquifer restoration control scheme is preventing northward flow of contamination toward these wells.

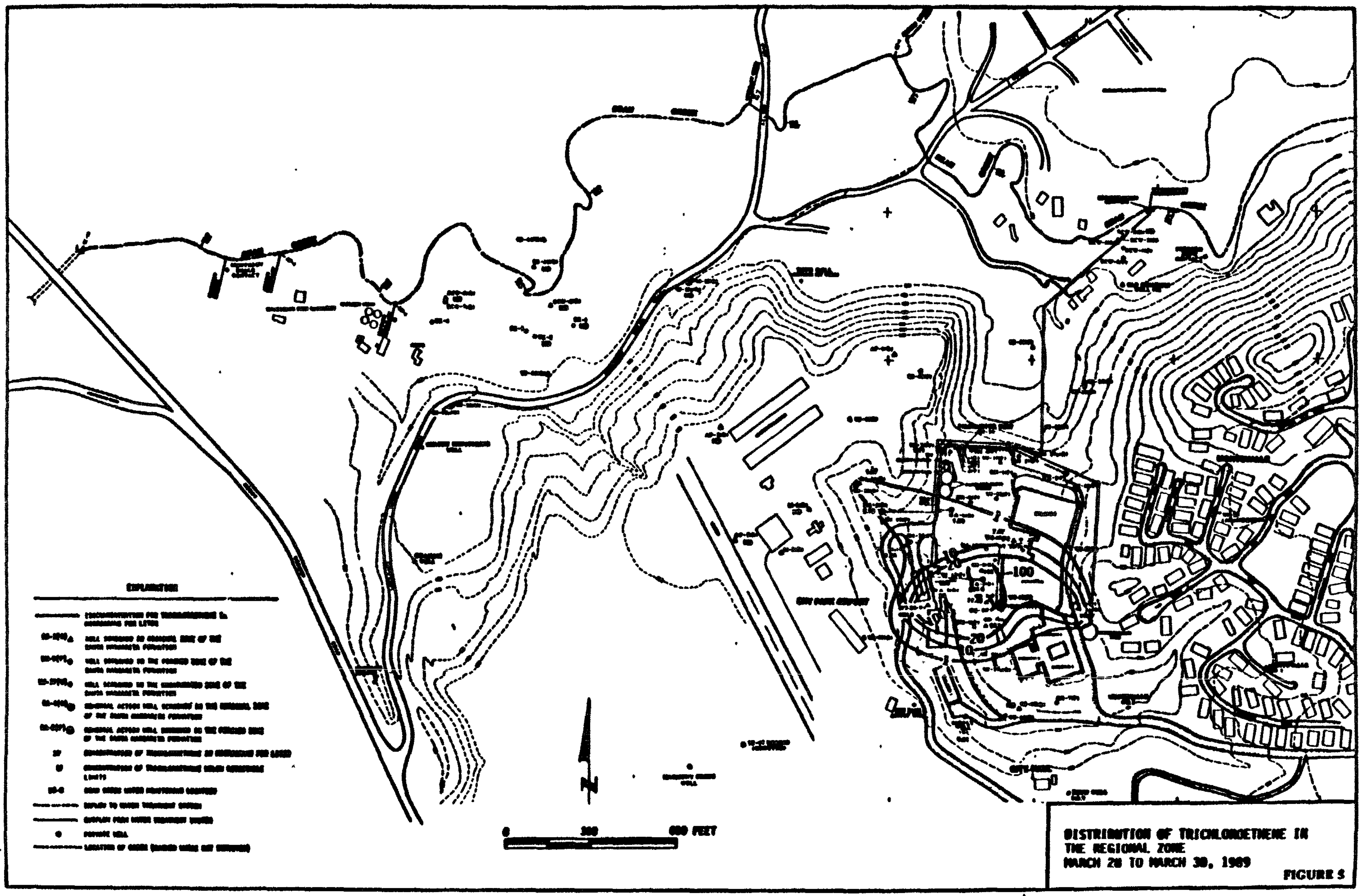
- The aquifers in the Monterey and Lompico formations underlie the contaminated Santa Margarita Formation. There is an apparent upward gradient from the Lompico to the Monterey, which indicates that the potential for contaminants to flow from the Santa Margarita to the Monterey or Lompico in the vicinity of the plume is very small.

- Bean Creek is directly connected to the perched zone in the area upstream from Ruins Creek extending at least to the point where treated water is discharged to Bean Creek. Downstream from Ruins Creek, Bean Creek is hydraulically connected to the regional aquifer. Although contamination had previously been found in Bean Creek, more recent sampling shows contamination is below detection limits.



DISTRIBUTION OF TRICHLOROETHENE IN
THE REGIONAL ZONE,
MAY 22 TO 26, 1987

FIGURE 4



DISTRIBUTION OF TRICHLOROETHENE IN
THE REGIONAL ZONE
MARCH 28 TO MARCH 30, 1989

FIGURE 5

VI. SUMMARY OF SITE RISKS

EPA policy and guidance provide that the potential risk to human health and the environment be evaluated under the No-Action scenario. This scenario assumes the unrestricted access to site contaminants (including soils and groundwater) and that all on-going treatment and/or mitigation measures are terminated immediately. Evaluation of the No-Action scenario is a requirement of the National Contingency Plan (NCP), 40 CFR Section 300.68(e) and (f) to represent a baseline condition.

The information provided by the baseline risk assessment is then used to characterize the current and potential threats posed by the site to human health and the environment.

HUMAN HEALTH RISK

The risk assessment process consists of several major steps: contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

The contaminant identification step consists of identifying those compounds that, because of their toxicity or other health risks, are considered to be contaminants of concern at the site. Those compounds detected most frequently, the media of detection, and the maximum and mean concentrations detected are shown in Table 1. Indicator compounds represent the most toxic, mobile, and persistent chemicals detected on-site and those potentially toxic chemicals present in the largest amounts. The following compounds were selected as indicator chemicals for the Watkins-Johnson site:

Barium	cis-1,2-Dichloroethylene
Chromium	Methylene Chloride
Nickel	Tetrachloroethylene
Silver	1,1,2-Trichloroethane
Chloroform	Trichloroethylene
1,1-Dichloroethylene	Vinyl Chloride

The exposure assessment step of the risk assessment involves identification of current and future pathways of exposure. Potential pathways involving on-site personnel appear most likely to lead to unacceptable exposure levels if the ongoing aquifer restoration program is discontinued or is not successful. Further on-site construction might disturb the contaminated soil and lead to a potential hazard for construction workers or plant personnel. Several potentially complete exposure pathways may exist in the future at the site; these could become future transport pathways. These include hypothetical wells for drinking water at the site, hypothetical wells at the former Sky Park Airport, hypothetical wells for residential development around the site and the wells used by the Silverking fish hatchery. These wells could be screened in either the perched zone or regional zone of the Santa Margarita aquifer.

The third step of the risk assessment is the toxicity assessment. Chemicals present at this site include both carcinogens and non-carcinogens. Three contaminants are of concern based on their potential ability to cause cancer: TCE is a Group B-2 agent, probable human carcinogen; 1,1-DCE is a Group C Agent, possible human carcinogen; and vinyl chloride is a Group A Agent, known human carcinogen. These classifications are based on the strength of scientific evidence that these agents may be carcinogenic. For TCE, there is sufficient evidence of carcinogenicity in animals, and inadequate evidence that the compound is carcinogenic in humans. For 1,1-DCE, there is only limited evidence the compound is carcinogenic in animals and the available evidence on humans is inadequate. For vinyl chloride, there is sufficient evidence of carcinogenicity in animals and humans. Cancer Potency Factors (CPFs) have been developed by the EPA's Carcinogenic Assessment Group (CAG) for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of mg/kg-day, are multiplied by the estimated intake of a potential carcinogen in milligrams per kilogram per day (mg/kg/day) to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risks highly unlikely. CPFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Several non-carcinogenic chemicals have been identified to be chemicals of concern at this site. Reference doses (RfDs) have been developed by the EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting non-carcinogenic effects. The RfD is an estimate, with an uncertainty of perhaps an order of magnitude, of a lifetime daily exposure for the entire population (including sensitive individuals) that is expected to be without appreciable risk of deleterious effects. Estimated intake of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to RfDs. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effect on humans). These uncertainty factors help ensure that the RFDs will not underestimate the potential for adverse non-carcinogenic effects to occur.

The last step in the risk assessment process is the risk characterization. At this point the information from the proceeding steps is combined to determine if an excess health risk is present at the site. Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factors. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper-bound, an individual has a one in one million chance of developing cancer as a result of site exposure to a carcinogen over a 70 year lifetime under the specific exposure conditions at a site. As is stated in the NCP (40 CFR Section 300.430(e)), "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}".

Table 2 summarizes the estimated carcinogenic risk at the site, based on a no-action scenario. Potentially significant carcinogenic risk from ingestion of groundwater from the perched zone is present, as well as the potential hazard of volatilization of chemicals during the aeration of water at the Silverking fish hatchery. These risks are mainly due to the presence of TCE. This is a hypothetical well scenario; at this time there are no wells being used within the contaminant plumes in either the perched zone or regional zone, except for an on-site well at Watkins-Johnson which is treated. Disturbance of the paved areas of the plant and soils beneath could present an increased carcinogenic risk in the future to any population using the perched or regional aquifer as a domestic water supply.

Potential concern for non-carcinogenic effect of a single contaminant in a single medium is expressed as a hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentrations in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI in excess of 1 is generally regarded by EPA as representing an unacceptable life-time, non-carcinogenic human health risk.

Table 3 summarizes the estimated non-carcinogenic risk at the site, based on a no action scenario. There is no significant non-carcinogenic human health hazard associated with exposure to groundwater from either the perched zone or regional zone or to on-site soil for any of the chemicals quantified in this Risk Assessment.

The aquifer restoration process now under way at the site has dramatically reduced the levels of the carcinogens and non-carcinogens at and in the vicinity of the site. However, actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare or the environment.

ENVIRONMENTAL RISKS

A detailed Preliminary Natural Resources Survey of the Watkins-Johnson site was performed by the U.S. Fish and Wildlife Service in 1987. The principal focus of this survey was potential endangerment to wildlife in the vicinity of the site which might occur due to contamination of Bean Creek. Based on the more recent rounds of surface water sampling, no contaminant concentrations have been detected in Bean Creek. Furthermore, the ongoing aquifer restoration begun in October 1986 has significantly reduced the extent of the groundwater contaminant plume so that it no longer intercepts or threatens to intercept Bean Creek.

There is no evidence, based on the survey, that any fish or wildlife trust resources inhabit the property. The industrial nature of the property and extensive coverage of soil by buildings and pavement prevent potential exposure of migratory birds to contaminated soil. The failure to detect volatile organic compounds in Bean Creek downstream of where the groundwater intercepts the creek suggests that aquatic life in the creek is not presently at risk from site-related contaminants.

VII. DESCRIPTION OF ALTERNATIVES

To facilitate the detailed analysis of the alternatives with respect to the nine evaluation criteria specified in the NCP, 40 C.F.R. Part 300.430, 55 Fed. Reg. 8849.8851, proposed site remedial activities were separated into four components. These components were: (1) groundwater containment and removal, (2) groundwater treatment, (3) treated water end use, and (4) source (soil contamination) control. Table 4 lists the remedial alternatives evaluated and their associated costs.

Groundwater Containment/Removal

Contamination has been identified in both the perched and regional zones of the Santa Margarita aquifer. In addition to "No Action", three options were evaluated to restrict and contain movement of the plume, as well as to collect and removed contaminated groundwater. These options include the use of gravity drainage, leachfields, and groundwater extraction. All options would require periodic groundwater monitoring to determine the effectiveness of the remedy and to verify achievement of the treatment standards. A specific monitoring program will be determined during the Remedial Design/Remedial Action (RD/RA) phase.

Gravity Drains: This technology uses gravity drainage to transfer contaminated groundwater from the perched zone into the regional zone where extraction by pumping is more efficient. The drain system currently operating on-site has been shown to be effective in permanently transferring contaminated groundwater from the perched to the regional zone. Contaminated perched zone groundwater enters through the upper drain portion of the structure and is transferred by gravity to the lower portion of the structure where it enters the regional zone. This type of drain would be removed upon completion of remedial activities thereby restoring the original degree of permeability between the two zones.

Leachfields (also referred to as "perched zone recharge galleries): The purpose of this technology is to use leachfields at the site to recharge water into the perched zone. A leachfield consists of a number of dry wells completed above the perched aquifer water table and connected in series to a water distribution line. By allowing water to infiltrate into the vadose zone above the perched zone, a groundwater mound(s) can be created to alter and control the movement of the contaminant plume in the perched zone.

The recharge system would be designed to provide maximum control of groundwater flow to minimize the migration of the contaminant plume outside the zone of influence of the capture/removal system. Pilot studies were conducted to evaluate perched zone groundwater containment and removal technologies, including gravity drainage, groundwater recharge (using the existing Building 8 leachfield), and extraction (using the Test Well). Combinations of options evaluated in the FS include perched zone gravity drains plus the Building 8 leachfield, gravity drains plus Building 8, 2, and 6 leachfields and the Test Well (existing well to be used for extraction), and gravity drains plus Building 8, 2, and 6 leachfields and soil flushing at the former Building 6 dilution tank.

Groundwater Extraction: This technology uses a combination of existing and new extraction wells to create a cone of depression to capture and remove the contaminant plume from the regional aquifer. Groundwater extraction from the perched zone has been shown to be difficult due to the local hydraulic characteristics and dewatering problems. There is currently one perched zone extraction well on-site that is operated intermittently and is considered a part of this option.

No Action: The no-action option represents a baseline against which the other alternatives are compared. No effective remedial strategies would be implemented in either the perched or regional zones. Existing gravity drains would be plugged, infiltration through the existing leachfield would be discontinued, and existing extraction wells would be abandoned. Contaminated groundwater would be allowed to migrate off-site and into Bean Creek.

Perched zone groundwater would migrate northward, leaking into the regional zone and eventually discharging into Bean Creek. This option provides no mitigation of existing risks, and would allow other areas to be impacted. These conditions would persist indefinitely until the contaminant plume had been diluted, completely discharged, or reduced by natural biological and chemical processes.

Groundwater Treatment

Several processes have been evaluated to remove chlorinated hydrocarbons from extracted groundwater consistent with the existing National Pollution Discharge Elimination System (NPDES) permit and as a requirement for discharge in conjunction with other disposal methods. The treatment technologies described below include granular activated carbon (GAC) adsorption, air stripping, and ultra violet (UV) oxidation. The no-action option is also summarized.

Granular Activated Carbon (GAC) Adsorption: This technology uses large volumes of GAC to filter contaminated groundwater. The filtration bed would be replaced with fresh GAC as necessary for the effective removal of contaminants; the spent GAC would be regenerated off-site. The current GAC treatment system on-site consists of two pressurized vessels each containing 20,000 pounds of GAC. The units are operated in a continuous mode with groundwater pumped directly into the distribution system at 20 pounds per square inch gauge (psig).

GAC is very effective in removing chlorinated hydrocarbons from water provided that the carbon is replaced periodically. The existing system has been shown to treat groundwater down to nondetectable levels. Over the long term, the only waste material produced is spent GAC which is returned to the manufacturer for regeneration. Contaminants are concentrated onto the carbon particles inside the unit and ultimately destroyed by thermal oxidation during reactivation of the spent carbon. Off-Gases from this process are scrubbed to neutralize any acid gases prior to discharge.

Air Stripping: This technology uses an air stripping tower to facilitate contact between clean air and contaminated groundwater in a countercurrent flowpath. The stripping tower is a vertical packed column in which water flows downward, contacting upward flowing air in thin films on the packing. A mass transfer of contaminants from the water phase to the air phase occurs. The air used to remove the contaminants would be collected for treatment by vapor phase GAC (as described above for groundwater) prior to ambient discharge.

A properly designed and operated air stripper can effectively remove volatile organics from water with common efficiencies of 99%. A safety factor would be built into the design to account for variations in influent concentrations, but a large concentration entering the stripper could conceivably exceed treatment standards even if cleaned to 99%. No hazardous by-products would be produced from the unit. Spent GAC would be regenerated, destroying the entrained contaminants, as described above.

Ultra Violet (UV) Oxidation: This technology uses a UV light source coupled with a chemical oxidizer (ozone or hydrogen peroxide) in a batch or plug flow reactor. UV catalyzes the hydrogen peroxide to form hydroxyl radicals. These react with organic materials, thereby completely oxidizing chlorinated hydrocarbons.

Various pilot studies have shown this technology to be successful in reducing chlorinated hydrocarbon concentrations in waste water to nondetectable levels. Data is not available for systems treating concentrations as low as those present at the site, therefore a pilot study would be warranted if this option were finally selected. There are no air emissions from this treatment process, and contaminants are completely and permanently destroyed. Implementation of UV oxidation at the site would require construction of additional facilities to house and power the operation.

No Action: This option would release contaminants directly to the creek increasing the potential for exposure to human and environmental receptors. Contaminant concentrations would eventually be reduced by dilution or volatilization, however the risk to the community and the environment would remain until the concentrations entering the creek reached ARARs. This situation would persist throughout the pumping program.

Treated Water End Use

Watkins-Johnson currently uses treated groundwater in three ways: on-site industrial and drinking water, off-site discharge to Bean Creek, and recharge to the perched zone. Concern has been raised that the water currently discharged to Bean Creek could be used as an off-site drinking water supply to offset existing groundwater pumpage. At this time, we estimate that only 25 gallons per minute of treated groundwater will be discharged to Bean Creek; this is the estimated minimum flow necessary to maintain the habitat and support aquatic life. If the estimated volume of the discharge to Bean Creek should increase significantly, EPA may consider designating other uses for the treated effluent. Such a change may be reflected in an Explanation of Significant Difference or other appropriate document. A change in the designated use of the treated effluent may include the off-site domestic use of treated groundwater in conjunction with the Creek discharge. The discharge to Bean Creek is an off-site discharge for which Watkins-Johnson must continue to obtain all appropriate permits, including an NPDES permit from the Regional Board, and comply with all applicable State and federal laws.

Source Control

The Risk Assessment prepared for this site indicates that existing soil contamination poses no significant risk to human health or the environment through direct contact. However, direct exposure may occur as a result of on-site excavation. In addition, existing contamination continues to threaten groundwater quality. Contamination has not been identified within the uppermost fifteen feet of soil. Most areas of detected soil contamination are beneath asphalt caps which significantly reduce the downward mobility of the residuals. The highest concentrations of soil contamination are in the area of the former Building 6 dilution tank. The detailed analysis evaluated four source control options. These were treatment by vapor extraction, by soil flushing, stabilization by capping and grading, and the no action option. A source control option(s) will be required to treat soils to a level that no longer presents a threat to the groundwater.

Soil Vapor Extraction: This technology uses a suction to remove organic contaminants from the soil matrix. A vacuum is applied to a dry well screened in the contaminated vadose zone. The vacuum applied is sufficient to cause residual contaminants to partition from the soil matrix into the soil gas and be evacuated from the well. Soil vapor may be treated at the surface to remove organic constituents prior to ambient discharge.

A pilot system operated at the site of the former Building 6 dilution tank indicated that soil vapor extraction is capable of removing small quantities of residual soil contamination. Effluent from the pilot system contained such small quantities of contaminants that health-based risk from this source would be negligible. However, a full-scale vapor extraction operation would require pretreatment of extracted vapors using, for example, fresh GAC, to ensure removal of vaporized volatile organic compounds (VOCs) prior to ambient discharge.

Soil Flushing: This technology is designed to wash the soil column in situ with sufficient volumes of water to completely desorb the contaminant mass. Water would be applied using shallow infiltration ponds constructed over the area to be washed. The water flushes the contaminants into the groundwater which must then be removed and treated.

A pilot study conducted at this site indicated that soil flushing would be effective in reducing the toxicity of residual soil contaminants at the site. Due to the area required for infiltration ponds, however, soil washing could only be performed in selected areas at the site where contamination does not exist. This option may also disturb hydrologic controls used to control plume migration.

Capping and Grading: The purpose of this technology is to minimize movement of soil-borne contaminants using a cover installed immediately above and adjacent to the contaminated volume of soil. The cover may be of any design which provides a low permeability and structural integrity so that permeability does not change over time. The cover should also be graded to carry away accumulated precipitation or surface run-off. Most of the surface areas at the site are already capped and used as parking areas.

Remedial Action Alternatives

Three complete remedial alternatives for the site were prepared using certain of the options described above. The options from three of the component areas emerged as being appropriate for all three remedial alternatives. Therefore, this ROD will summarize the analysis of alternatives using the same groundwater containment and removal, groundwater treatment, and source control options. Although a no-action option was evaluated for each component, it is not carried through as a remedial alternative for the site because it would not protective be of human health and the environment nor ARAR-compliant, and it is believed that the State would not accept a no-action alternative. Each alternative and its related implementation costs are detailed below and summarized on Table 4.

Each alternative will achieve State and federal drinking water standards throughout the regional and perched zones. See Table 6. The specific requirements for and costs of long term operation and maintenance (O&M) activities and institutional and engineering controls will be defined more precisely during the RD/RA phase.

Alternative 1: This alternative includes the use of leachfields to control movement of the perched zone contaminant plume; gravity drainage to transfer perched zone contamination to the regional zone; groundwater extraction to remove contaminated groundwater from both the perched and regional zones; GAC adsorption to treat the extracted groundwater; soil vapor extraction to remove VOCs from the soil; capping and grading to minimize the potential for mobilization of soil contaminants to the groundwater; and on-site industrial and consumptive use of treated water, off-site discharge to Bean Creek, and on-site recharge to the perched zone.

The capital cost for this alternative is estimated to be $837,738; the annual operation and maintenance cost (O&M) is estimated to be $167,820. The present worth of this alternative is estimated to be $2,156,243.

Alternative 2: This alternative includes the use of leachfields to control movement of the perched zone contaminant plume; gravity drainage to transfer perched zone contamination to the regional zone; groundwater extraction to remove contaminated groundwater from both the perched and regional zones; air stripping to treat the extracted groundwater with GAC adsorption to treat air emissions; soil vapor extraction to remove VOCs from the soil; capping and grading to minimize the potential for mobilization of soil contaminants to the groundwater; and on-site industrial and consumptive use of treated water, off-site discharge to Bean Creek, and on-site recharge to the perched zone.

The capital cost for this alternative is estimated to be $611,938; the annual operation and maintenance cost (O&M) is estimated to be $167,820. The present worth of this alternative is estimated to be $1,930,443.

Alternative 3: This alternative includes the use of leachfields to control movement of the perched zone contaminant plume; gravity drainage to transfer perched zone contamination to the regional zone; groundwater extraction to remove contaminated groundwater from both the perched and regional zones; UV oxidation to treat the extracted groundwater; soil vapor extraction to remove VOCs from the soil; capping and grading to minimize the potential for mobilization of soil contaminants to the groundwater; and on-site industrial and consumptive use of treated water, off-site discharge to Bean Creek, and on-site recharge to the perched zone.

The capital cost for this alternative is estimated to be $703,938; the annual operation and maintenance cost (O&M) is estimated to be $139,000. The present worth of this alternative is estimated to be $1,796,171.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparison of alternatives using nine evaluation criteria. These criteria, which are listed below, are derived from CERCLA and and the National Contingency Plan.

1. Protection cf human health and the environment.
2. Compliance with applicable or relevant and appropriate requirements (ARARs).
3. Long term effectiveness and permanence.
4. Reduction of toxicity, mobility or volume through treatment.
5. Short term effectiveness.
6. Implementability.
7. Cost.
8. State acceptance.
9. Community acceptance.

Under Section 121 of CERCLA, the selected remedial action must be protective of human health and the environment, ARAR-compliant, cost effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The following sections describe the various alternatives in light of the nine criteria listed above.

Protection of Human Health and the Environment

All three alternatives are protective of human health and the environment.

Compliance with ARARs

Each of the three alternatives complies with its respective ARARs.

Long Term Effectiveness and Permanence

Alternative 1 is the most effective and permanent solution in the long term. GAC adsorption will treat contaminated groundwater to nondetectable levels and destroy the contaminants removed. Although Alternative 3 has the potential to be equally effective in the long term, no data is available to indicate the effectiveness of UV oxidation in treating influent concentrations as low as those now present at the Watkins-Johnson site. Alternative 2 (treatment by air stripping and GAC adsorption) is capable of treating to nondetectable levels and permanently destroying the removed contaminants, but a large influent contaminant concentration can exceed the design capacity of the stripper, allowing effluent discharges in excess of the treatment standards. This would impede its long-term reliability.

Reduction of Toxicity, Mobility, or Volume Through Treatment

All three alternatives use treatment to permanently and significantly reduce the toxicity, mobility or volume of contaminants in both the soil and groundwater. Therefore, all three satisfy the statutory preference for remedies utilizing as a principal element treatment that significantly reduces the toxicity, mobility or volume of the hazardous substance.

Short Term Effectiveness

Alternative 1 performs best under this criterion because it poses the least risk to human health and the environment during implementation. Although Alternative 3 has the potential to be equally effective in the short term, no data is currently available to indicate whether implementation would pose any risk to human health and the environment. Alternative 2, using treatment by air stripping and GAC adsorption, has the potential for posing impacts to human health and the environment during implementation. While air stripping is capable of treating to nondetectable levels and permanently destroying the removed contaminants, a large influent contaminant concentration could exceed the design capacity of the stripper, allowing effluent discharges in excess of the treatment standards. All the remedial alternatives will achieve their remediation goals within similar time frames.

Implementability

The three alternatives perform equally under this criterion. The administrative and technical feasibility of each of the alternatives is comparable.

Cost

Alternative 3 is the least costly alternative. Alternative 1 is the most costly alternative.

State Acceptance

It is believed that the State would accept any of the three alternatives evaluated.

Community Acceptance

It is believed that the community would accept any of the three alternatives evaluated.

IX. THE SELECTED REMEDY

Alternative 1 is the selected remedy for this site. The selected remedy provides the best balance of tradeoffs with respect to the five balancing criteria, factoring in State and community acceptance. Therefore, this alternative utilizes permanent solutions and alternative technology or resource recovery technology to the maximum extent practicable. Although it is the most expensive alternative, Alternative 1 provides the best long- and short-term effectiveness, permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substance through treatment, and can be implemented at the site. The selected remedy employs treatment as a principal element that significantly and permanently reduces the toxicity, mobility, or volume of the hazardous substances. It is protective of human health and the environment, complies with federal and State ARARs and is cost-effective. The costs of this alternative are proportional to its overall effectiveness.

The goal of this remedial action is to restore groundwater to its beneficial use, which is as a sole source aquifer for drinking water at this site. Based on information obtained during the remedial investigation and on a careful analysis of all remedial alternatives, EPA and the State of California believe that the selected remedy will achieve this goal. The selected remedy will include groundwater extraction for an estimated period of eight years, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation.

Periodic groundwater monitoring will be required to determine the effectiveness of the remedy and to verify achievement of cleanup standards. Long term operation and maintenance (O&M) activities, institutional and engineering controls, and their costs may also be required. Such requirements and a specific monitoring program will be defined more precisely during the RD/RA phase.

ARARs

As noted above, this alternative would comply with all federal and State applicable or relevant and appropriate requirements (ARARs) as listed in Tables 5 and 6.

The treatment standards selected for the groundwater remedy are presented in Table 6. These treatment standards were selected by the process described below. As per Section 300.430(e) of the NCP, federal MCLGs, where promulgated, were initially selected as the treatment standards. In the event that the MCLG has been set at a level of zero, then the federal MCLs, where promulgated, were selected. In the event that a more stringent MCL has been promulgated by the State of California, then the State MCL was selected as the treatment standard. The selected remedy will achieve treatment standards in both the regional and perched zones.

In the case of zinc, the only number available was the Secondary federal MCL, and this number was selected as the treatment standard. For several chemicals (1,2-dichlorobenzene, cadmium and lead), only proposed MCLs or MCLGs exist, and these values were chosen as treatment standards. In the case where no federal MCLGs, federal MCLs or State MCLs are promulgated or proposed, then the State Action Level or Applied Action Level was selected as the treatment standard. This was the case for 1,1-dichloroethane. In the case of nickel, the only value available was an EPA Health Advisory, and this value was selected as the treatment standard. In the case of vanadium, no values were identified for selection as treatment standards. However, this chemical was only detected in 1 of 21 perched zone samples and 2 of 32 regional zone samples, and was, thus, eliminated from further consideration.

The following compounds were detected in groundwater at concentrations exceeding their selected treatment standards: trichloroethylene, vinyl chloride, tetrachloroethylene, 1,1-dichloroethylene, 1,1-dichloroethane, 1,4-dichlorobenzene, cis-1,2-dichloroethylene and silver. Treatment to the specified standards will result in a residual risk within the range of 10^{-4} to 10^{-6}.

Health-based ARARs pertaining to soil contamination are not available for the site. The soil contamination will be remediated to a level that no longer poses a threat to the groundwater. This alternative also complies with the Monterey Bay Unified Air Pollution Control District (MBUAPCD) Rule 1000 which is applicable to any air emissions associated with this remedial action.

The land disposal restrictions of Subtitle C of the Resource Conservation and recovery Act (RCRA) are not ARAR for this remedial action. The treatment technology used in this alternative will treat the contaminated groundwater to nondetectable levels. Once the groundwater is so treated, it no longer contains hazardous waste and no longer is subject to regulation under Subtitle C of RCRA.

Technical Aspects of the Selected Remedy

The selected remedy for the site involves several components, including containment and removal of contaminated groundwater within the perched and regional zones, treatment of extracted groundwater, and implementation of limited source control measures. The costs for the selected remedy are summarized in Table 8.

At several points during the discussion of the selected remedy, specific remedial designs are referenced including the number and general location of gravity drains, extraction wells, and leachfields; the pumping rates of extraction wells; the discharge rate from the GAC system; the method of discharge from the GAC system; etc. EPA recognizes that specific engineering modifications regarding the selected technologies may be identified during the Remedial Design and Remedial Action (RD/RA) phases.

The selected remedy includes a system to control the perched zone contaminant plume while it is being captured and transferred to the regional zone (for extraction and treatment) by the perched zone drain system. The Building 8 leachfield located in the north parking area west of Building 8, would have the largest impact on controlling migration of the perched zone contaminant plume by creating a large groundwater mound directly downgradient of the contaminant plume. The Building 6 leachfield, to be located on the northeast corner of Building 5, would create a groundwater mound to the east of the contaminant plume. The Building 2 leachfield, located just east of Building 7, would be used to create a groundwater mound to the west of the perched zone contaminant plume. These three systems would create a cordon of groundwater mounds which would surround the the perched zone contaminant plume on three sides. The fourth side is upgradient of the plume, so migration of the contaminant plume would be controlled by the natural gradient. The Test Well, which is located west of the Building 8 groundwater mound, would be used as an extraction well to aid in the capture of any contaminants that exist in that area and would also capture any portion of the contaminant plume that may get past the barrier created by the Building 2 and Building 8 leachfields.

This configuration would maintain the contaminant plume in its current location around the perched zone drain system, allowing the drain system to capture the contaminant plume and transfer it into the regional zone. This alternative presents a minimal risk to the public, as the system assures maximum containment of the plume. Risk to the environment is substantially reduced by the containment of the plume until the perched zone is restored. By employing this alternative, the time required for perched zone groundwater to meet the treatment standards is estimated to be 7 years.

Once the treatment standards have been met in the perched zone and a sufficient monitoring period has elapsed, the recharge systems will be shut down. This will result in the dissipation of the groundwater mounds created in the perched zone. The perched zone drain system will be shut down, thereby reducing flow from the perched zone to the regional zone. The Test Well will also be shut down. These actions will result in the perched zone returning to natural flow conditions. Groundwater quality monitoring will be performed to ensure that contaminant levels remain below the treatment standards and to evaluate the progress of the remedy. The monitoring program will be defined during the RD/RA phase.

The selected remedy addresses the contaminated plume in the regional zone by using a five well groundwater extraction system, including four extraction wells located on-site and one extraction well situated on the Sky Park Airport property. The four on-site extraction wells create a cone of depression that captures a major portion of the regional zone contaminant plume. The well on the airport property will be used to capture any portion of the contaminant plume that migrates beyond the influences of the on-site extraction wells. Groundwater quality monitoring will be necessary to ensure that contaminant levels remain below the treatment standards and to evaluate the progress of the remedy. It is estimated that this system will require 8 years to reach the treatment standards in the regional zone.

The total pumping rate for the four extraction wells during the fourth quarter of 1989 was 209 gallons per minute (gpm); however, the total projected pumping rate is estimated to be 110 gpm. The pumping rate is likely to change during the remedial action process. Once the regional zone contaminant plume concentrations have reached the treatment standards, the extraction wells will be shut down. This will result in the dissipation of the cone of depression and a return to natural flow conditions. Continued groundwater quality monitoring on at least a quarterly basis will occur to ensure that contaminant levels remain below the treatment standards. The specific details of the groundwater monitoring program and the long term O&M requirements will be determined during the RD/RA phases.

Contaminated groundwater removed by the 5 extraction wells will be treated using a GAC adsorption system. This system is already on site and operating.

The on-site GAC system treats contaminant concentrations to non-detectable levels. Effluent from the GAC system is discharged in three manners: on-site use at the Watkins-Johnson plant, on-site recharge through leachfields to maintain the perched zone groundwater mounds, and off-site discharge to Bean Creek. Discharge to Bean Creek is an off-site activity; therefore, Watkins-Johnson must comply with all applicable laws and obtain all applicable permits for this discharge.

Table 8 indicates the current (based on fourth quarter 1989 data) and projected water use rates for effluent from the GAC system. Discharge to Bean Creek is considered a beneficial use of a relatively minimal amount of water. This water assists in maintaining flow within Bean Creek, thereby protecting the associated natural habitat.

Based on the Risk Assessment, there is no significant risk posed to human health or the environment by leaving currently documented, residual soil contamination in place. However, by using source control measures and preventing further release of contaminants from soil to groundwater, the overall time for the groundwater remedy will be reduced. This will be accomplished through soil vapor extraction and capping and grading.

Using this method, a vacuum is applied to a dry well screened in the contaminated portion of the vadose zone. The applied vacuum is sufficient to cause residual contaminants to partition from the soil matrix into the soil gas and be evacuated from the well. Vapors removed by this system will be passed through a vapor-phase GAC adsorption system in order to comply with ARARs set by the MBUAPCD Rule 1000.

The exposed area of soil contamination (in the vicinity of the Building 6 diluticn tank) has been capped since EPA published its preferred alternatives in the Proposed Plan. The cap consists of an eight-inch thick slab of concrete poured over and adjacent to the area of soil contamination at Building 6 and forming the foundation of an extension to that at building. This concrete cap is surrounded on three sides by a three-inch thick asphalt parking area. The concrete and asphalt covers are anticipated to perform adequately in mitigating the potential mobilization of soil contaminants to the groundwater. EPA selects this approach to the capping and grading portion of the selected remedy and approves its construction.

X. STATUTORY DETERMINATIONS

The selected remedial action is protective of human health and the environment. For each pathway of exposure at the site, the remedy eliminates, reduces or controls the risks posed. The overall site risk will be reduced to within the 10^{-4} to 10^{-6} range for carcinogens and the Hazard Indices for non-carcinogens will be less than one. Implementation of the remedy will cause no unacceptable short-term risks or cross-media impacts.

The selected remedial action complies with all federal and State ARARs. These ARARs are listed on Tables 5 and 6, attached to and incorporated herein by reference.

The selected remedial action is cost-effective. The overall effectiveness of the selected remedial action is proportional to its cost, in that it represents a reasonable value for the money to be spent.

As discussed in the Comparison of Alternatives Section of this ROD, the selected remedy utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The selected remedy provides the best balance of tradeoffs among the alternatives with respect to the evaluation criteria, especially the five balancing criteria. The selected remedy was superior to the other alternatives under the long-term effectiveness and permanence and short-term effectiveness criteria. All the remedial alternatives evaluated in the remedy selection process were acceptable to the State and the community.

The selected remedial action satisfies the statutory preference for selecting remedies in which treatment that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants and contaminants is a principal element. The remedial action uses treatment to address the contaminated groundwater, which is the principal threat posed by the site. GAC adsorption will remove volatile organic chemicals from the groundwater and will achieve a permanent and significant reduction of the toxicity, mobility or volume of the contaminants. Similarly, vacuum extraction followed by vapor-phase GAC adsorption will remove volatile organic chemicals from contaminated soil, thereby also meeting the statutory preference.

XI. DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan identified several options as potentially appropriate for use at the site that were not discussed in this ROD. These options were: physical controls, slurry walls, injection wells, infiltration galleries, sheet pilings, and collection trenches. These containment options actually had been screened out from the selection process in the detailed analysis of the Feasibility Study due primarily to technical infeasibility at the site. EPA received no support for these options during the public comment period for the Proposed Plan. Therefore, they were omitted from further analysis in the ROD.

Based on comments received from Watkins-Johnson in a letter dated April 13, 1990, one additional significant change to the Proposed Plan is reflected in the "Selected Remedy" section of the ROD. Under the Proposed Plan, source control was to be implemented using a combination of two alternatives: soil vapor extraction and capping and grading. As Watkins-Johnson has pointed out, the exposed area of soil contamination (in the vicinity of the former Building 6 dilution tank) has since been capped. Therefore implementation of this portion of the remedy as proposed no longer is necessary. Vapor extraction remains as part of the Selected Remedy to be implemented at the site.

XII. RESERVATION OF RECORD

The precise identification of long-term operation and maintenance activities and the use of engineering and institutional controls, the details of an ongoing groundwater monitoring program, and the costs of each of these activities will be identified during the RD/RA phase for the site.

RESPONSE SUMMARY

The Proposed Plan for the Watkins-Johnson site was issued to the public and announced that the public comment period would extend from February 14, 1990 through April 14, 1990. The Proposed Plan described EPA's preferred remedial alternatives for contaminated groundwater and soil at the site. On February 28, 1990, EPA briefed members of the Scotts Valley Town Council on the Proposed Plan, and on March 7, 1990 EPA presented the Proposed Plan at the public meeting.

SUMMARY OF COMMENTS RECEIVED

During the public comment period, EPA received only two letters regarding the Proposed Plan for the site. One comment letter, dated February 28, 1990 was provided by a group of residents from a local condominium mobile home park, and second comment letter, dated April 13, 1990, was provided by the Watkins-Johnson Company. The Chairman of the Board of Directors for the same residents group also provided verbal comment during the public meeting. EPA received written comments on the proposed remedy from the California Department of Health Services and the Central Coast Region of the California Regional Water Quality Control Board. The substantive comments and EPA's responses are summarized below.

Residents Group Comment:

The residents group requested access to that effluent from the on-site GAC system which is currently being discharged to Bean Creek, in order to help to help satisfy their water supply needs. Based on their calculations, the group estimated that with access to this water they could cut back their demands on the Santa Margarita aquifer, thereby saving approximately 280 ac/ft per year. The group pointed out that the transfer of this water was a relatively simple matter and that the distance involved was less than 100 yards.

EPA Response:

EPA considered, but rejected at this time, the residents' proposed option of allowing the treated effluent to be used as a public water supply source rather than discharging the treated effluent into Bean Creek. The residents' calculations were based on a discharge rate of 187 gpm from the on-site GAC system to Bean Creek. However, the current discharge rate to Bean Creek is 157 gpm, and the projected discharge rate is estimated to be 25 gpm. Based on the projected discharge rate to Bean Creek, EPA has determined that continued discharge to Bean Creek is a beneficial use of this water, as it assists in maintaining flow within the Creek, thereby protecting the associated natural habitat. In the event that the actual discharge to Bean Creek significantly exceeds the estimated 25 gpm rate, EPA may consider changing the designated method of disposal of the treated ef-

fluent. This change would be reflected in an Explanation of Significant Difference or other appropriate document. EPA would only consider designating the water for use as an off-site drinking water supply if the community receiving the water and Watkins-Johnson reach an agreement regarding the responsibility for conducting appropriate monitoring and for the costs of monitoring and distribution.

Watkins-Johnson (WJ) Comments:

1. WJ commented that the mechanism for creating groundwater mounds should be referred to as perched zone recharge galleries rather than leachfields.

EPA Response:

The first time the term "leachfields" appears within the ROD, EPA noted that these may also be referred to as "perched zone recharge galleries." However, in order to maintain consistency with the Proposed Plan, EPA has retained the term "leachfields" throughout the ROD. The term "leachfield" as used in the ROD is synonymous with the term "perched zone recharge gallery," as used in the FS.

2. WJ pointed out that Section 121(e) of CERCLA states "No federal, State or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." Furthermore WJ pointed out that Section 300.400(e)(1) of the National Contingency Plan defines "on-site" for this purpose to include the "areas extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action."

EPA Response:

EPA agrees with the commenter that no federal, State or local permit shall be required for any CERCLA response action conducted entirely on-site. The remedy selected in this ROD, however, involves both on-site and off-site discharges. Although no permit will be required for the discharges into the on-site leachfields, Watkins-Johnson must comply with all the substantive requirements that any permit would have required. Watkins-Johnson will be required to obtain all necessary permits, and comply with all applicable laws, for the off-site discharges of treated effluent into Bean Creek.

3. WJ pointed out that the Proposed Plan calls for the use of five gravity drains and five production wells. WJ requested that the specific number of wells and flow rates be adjusted to optimize the cone of depression beneath the site, with field data dictating the variable number of units that may be operating at any given moment. Further, WJ pointed out that EPA's "Guidance on Preparing Superfund Decision Documents," Interim Final, EPA/540/G-89/007, July 1989, states the following:

"This section of the ROD remedy selection should mention that some changes may be made to the remedy as a result of the the remedial design and construction process. The ROD should include a clear statement that such changes in general, reflect modifications resulting from the engineering design process."

EPA Response:

EPA acknowledges the comment and has incorporated it into the "Selected Remedy" section of the ROD. The Selected Remedy specifies requirements regarding gravity drains and extractions wells; however, provisions have been included in the event that engineering modifications are required during RD/RA.

4. WJ pointed out that recent computer modeling indicates that the rate of groundwater extraction and the rate of discharge from the GAC system can be decreased, while still allowing for effective containment of the contaminant plume.

EPA Response:

EPA has revised the "Selected Remedy" section of the ROD to clarify that engineering details such as the rate of groundwater extraction and discharge may be determined during the RD/RA.

5. WJ pointed out that the exposed area of residual soil contamination which the Proposed Plan requires to be capped, has already been capped. Therefore, WJ felt that this section of the Proposed Plan was no longer required.

EPA Response:

EPA has addressed this change in site condition in the "Documentation of Significant Changes" section of the ROD. Although the cap component of the preferred alternative identified in the Proposed Plan has been completed, the remedy selected in this ROD maintains a cap as a component of the remedial action. The ROD incorporates the cap component to ensure that the cap is maintained as part of the remedial action.

6. WJ proposed groundwater treatment standards consisting of MCLs at the property line with a goal of five times the MCL inside the property line or until a zero slope occurs on the groundwater concentration vs. time graph for a period of one year. WJ supported this comment with the following statement taken from an October 18, 1989 memorandum from Jonathan Z. Cannon, OSWER Acting Assistant Administrator:

"In many cases it may not be possible to determine the ultimate concentration reductions achievable in the groundwater until the groundwater extraction system has been implemented and monitored for some period of time.

Records of Decision should indicate the uncertainty associated with achieving cleanup goals in the groundwater.

In general, RODs should indicate that the goal of the action is to return the groundwater to its beneficial uses; i.e., health based levels should be achieved for groundwater that is potentially drinkable. In some cases, the uncertainty in the ability of the remedy can be specified without a contingency. However, in many cases, it may not be practicable to attain that goal, and thus it may be appropriate to provide in the ROD for a contingent remedy, or for the possibility that this may only be an interim ROD. Specifically, the ROD should discuss the possibility that the information gained during the implementation of the remedy may reveal that it is technically impractical to achieve health-based concentrations throughout the area of attainment, and that another remedy or contingent remedy may be needed."

EPA Response:

The beneficial use of aquifer underlying the WJ site is as a drinking water source. The NCP specifies that MCLs and MCLGs over zero shall be attained by remedial actions for groundwater that is a current or a potential source of drinking water when such are relevant and appropriate to the circumstances of the release. 40 C.F.R. 300.430(i)(B), 55 Fed. Reg. 8848. EPA has determined that the Safe Drinking Water Act MCLs and MCLGs above zero are the relevant and appropriate cleanup standards for the groundwater underlying the WJ site. See, e.g., 40 C.F.R. 300.400(g)(2), 55 Fed. Reg. 8848. As explained in the preamble to the NCP, it is EPA's policy to attain ARARs to ensure protection at all points of potential exposure. 55 Fed. Reg. 8753. Interim response actions and pilot studies taken at the WJ site indicate that State and federal MCLs and federal MCLGs over 0 are technically practicable to attain throughout the contaminated groundwater plume. The circumstances of the WJ site, therefore, do not support establishing an alternate point of compliance with ARARs, such as at the property line, as suggested by WJ. However, EPA acknowledges that information gained during implementation of the remedy may reveal technical obstacles to attaining the drinking water standards required in this ROD. In that event, EPA will evaluate the technical data and determine if a change in the cleanup standards required in this ROD is warranted. Such a change may entail issuing a technical impracticability waiver from a specific ARAR, or other documentation, as appropriate.

7. In regard to soil vapor extraction, WJ commented that it "Has great difficulty in implementing a remediation technique that has dubious benefit to the overall cleanup strategy." WJ supported this comment with the following statement:

"Here Watkins-Johnson has already spent over $50,000 on vapor extraction. This effort was cost-effective at the outset -- eight kilograms of contaminant mass were extracted in the first few weeks. However, after that, the effectiveness of the remedy dropped off quickly, to the point where only 20 grams per day were being removed. Therefore, the incremental costs of removing the remaining mass will be proportionally high compared with the effectiveness of the process. Unless EPA identifies a soil cleanup goal, it is not possible to perform the cost-effectiveness analysis that the NCP requires. Because EPA has already concluded that soil contamination presents no health hazards, EPA should follow its guidance document entitled "Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater," EPA/540/2-89/057/, Oct. 1989."

EPA Response:

On May 8, 1990 representatives from WJ, EPA and DHS met to discuss the issue of whether soil vapor extraction is needed as part of the remedial action at the site. WJ representatives presented evidence to document that vapor extraction was no longer necessary. EPA and DHS representatives both agreed, however, that existing information is not adequate to document that contamination in the vadose zone is not a continuing source of contamination of the groundwater. Therefore, EPA has selected a remedial action that includes soil vapor extraction as a component. However, WJ may provide technical information to EPA during the remedial design stage to show that vapor extraction is no longer necessary. EPA will consider such information and decide whether any change of a component of the selected remedial action is warranted. Such a change would be reflected in an Explanation of Significant Differences or other appropriate document.

EPA can provide WJ with a numerical model developed to approximate the leaching of soil contaminants to the groundwater. This model may be calibrated and used with site-specific data to aid in determining when residual soil contamination no longer poses a threat to groundwater.

California Regional Water Quality Control Board,
Central Coast Region (The Regional Board) Comments:

1. The Regional Board submitted comments to EPA strongly objecting to any change to the remedial action allowing a cleanup standard less stringent than State or federal drinking water standards. The Regional Board referred to the Cleanup and Abatement Order it issued to WJ in 1986 which required the company to attain approximately one-half the level of the present MCLs. The Regional Board urged a conservative approach in establishing cleanup levels due to the aquifer's designation as a sole source aquifer.

EPA Response:

As discussed above in response to WJ comment 6, EPA agrees that the relevant and appropriate cleanup standards for the WJ groundwater plume are the federal and State drinking water standards. EPA has specified the federal and State MCLs and the federal MCLGs over zero, and the State Applied Action Level for 1,1-dichloroethane as the specific cleanup standards in this ROD. See Table 6.

2. The Regional Board commented that the National Pollutant Discharge Elimination System (NPDES) permit under which WJ currently discharges into Been Creek should not be rescinded.

EPA Response:

EPA agrees that discharges into Bean Creek should continue under the authority of an NPDES permit. EPA has determined that the discharge point into Bean Creek is an off-site discharge and thus does not qualify for the permit exemption provided in section 121(e)(1) of CERCLA. See EPA response to WJ comment 2.

California Department of Health Services (DHS) Comments:

1. DHS suggested EPA delete the reference to "Total Threshold Limit Concentration" for use in site characterization.

EPA Response:

As requested, EPA has withdrawn the reference to "Total Threshold Limit Concentration."

2. DHS commented that the State would object to the selection of a remedial action that did not require source control measures. DHS provided the following reasons: "The extent of the soil contamination is not fully characterized; the length of time needed for remediation may be lengthened; and future land use and building maintenance may disturb the soils."

EPA Response:

EPA has selected a remedial action that requires soil vapor extraction and capping as source control measures to minimize the potential for mobilization of soil contaminants into the groundwater.

3. DHS requested further specification of the groundwater monitoring program at the site.

EPA Response:

The ROD specifies that the performance of the remedial action will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. The details of the groundwater program will be determined during the RD/RA phases of the remedial action.

3. DHS commented that the California Environmental Quality Act (CEQA) should be included as an ARAR for the WJ site.

EPA Response:

EPA has determined that the requirements of CEQA are no more stringent than the requirements for environmental review under CERCLA, as amended by SARA. Pursuant to the provisions of CERCLA, the NCP and other federal requirements, EPA's prescribed procedures for evaluation of environmental impacts, selecting a remedial action with feasible mitigation measures, and providing for public review, are designed to ensure that the proposed action provides for the short-term and long-term protection of the environment and public health and hence perform the same function as and are substantially parallel to the State's requirements under CEQA.

Since EPA has found that CERCLA, the NCP, and other federal requirements are no less stringent than the requirements of CEQA, EPA has determined that CEQA is not an ARAR for this site.

EPA will continue to cooperate with DHS and other State and federal agencies during the design phase of the remedial action to clarify further environmental review and mitigation requirements and ensure that they are fulfilled.

Table 1

Concentrations of Contaminants at the Watkins-Johnson Site

Chemical	Ground Water, mg/L						Soil, mg/kg		
	Perched Zone			Regional Zone					
	Maximum[1]	Mean[2]	Detects[3]	Maximum	Mean	Detects	Maximum	Mean	Detects
Organics									
Chloroform	7.0E-3	1.1E-3	2/73	2.0E-3	5.2E-4	4/81	6.1E-1	5.3E-2	6/9
1,2-Dichlorobenzene	4.0E-3	1.7E-3	19/73	7.5E-4	4.8E-4	3/81	---[4]	---	ND[5]
1,4-Dichlorobenzene	8.0E-3	1.3E-3	15/73	---	---	ND	---	---	ND
1,1-Dichloroethane	1.0E-2	2.0E-3	34/73	3.0E-3	5.5E-4	11/113	---	---	ND
1,1-Dichloroethene	1.1E-2	1.8E-3	23/73	7.5E-3	8.2E-4	14/81	1.0E-1	3.5E-2	1/3
cis-1,2-Dichloroethene	5.3E-2	5.1E-3	37/73	8.0E-3	7.5E-4	22/113	8.9E-2	6.8E-2	1/1
Methylene Chloride	---	---	ND	---	---	ND	1.1E+1	1.9E+0	12/30
Tetrachloroethene	2.5E-2	4.2E-3	13/73	2.9E-2	9.8E-4	14/113	1.4E+0	2.5E-1	4/9
1,1,1-Trichloroethane	4.3E-2	2.8E-3	9/73	8.0E-3	7.2E-4	19/113	3.1E-1	1.2E-1	4/12
1,1,2-Trichloroethane	3.0E-3	1.1E-3	4/73	3.0E-3	5.5E-4	8/113	1.0E-1	4.5E-2	1/3
Trichloroethene	5.5E-1	4.6E-2	47/73	1.1E-1	9.0E-3	42/113	9.3E+0	1.8E-1	18/41
Vinyl Chloride	6.0E-3	1.3E-3	11/73	---	---	ND	---	---	ND
Metals									
Arsenic	1.7E-2	2.7E-3	2/21	---	---	ND	1.4E+0	1.4E+0	1/16
Barium	1.4E-1	3.1E-2	20/21	3.4E-2	7.3E-3	24/32	8.3E+1	4.5E+1	16/16
Cadmium	4.8E-3	1.7E-3	5/21	7.4E-3	1.5E-4	3/32	6.2E-1	1.2E-1	4/16
Chromium	[illegible].4E-3	2.3E-2	12/21	3.4E-2	8.2E-3	3/32	1.1E+1	6.9E+0	16/16
Copper	2.7E-2	7.0E-3	2/21	1.4E-2	5.8E-3	1/32	5.6E+1	1.2E+1	16/16
Lead	1.0E-3	5.2E-4	1/21	---	---	ND	1.3E+0	8.6E-1	14/16
Mercury	2.0E-4	1.1E-4	2/21	2.0E-4	1.0E-6	1/32	---	---	ND
Nickel	3.7E-2	1.1E-2	9/21	6.9E-2	7.9E-3	2/32	6.7E+1	1.1E+1	14/16
Silver	1.2E-2	5.1E-3	11/21	6.1E-2	9.4E-3	21/32	7.5E+0	7.5E+0	1/16
Vanadium	1.3E-2	2.9E-3	1/21	6.7E-3	2.7E-3	2/32	1.1E+1	3.6E+0	13/16
Zinc	1.7E+0	1.1E-1	8/21	9.2E-1	1.7E-2	19/32	9.4E+1	2.2E+1	16/16

1 Maximum value detected
2 The concentration of each analyte reported as not detected was included in the computations as one-half the detection limit. Estimated concentrations of detected analytes included in the computation and duplicate samples are averaged
3 Number of samples above method detection limit/total number of samples
4 No value available
5 Chemical not detected in that medium

Table 2

Summary of Estimated Carcinogenic Risk at Watkins-Johnson Site

Exposed Population	Route	Medium	Cancer Risk	
			Best Estimate	MEI[1]
Adult Residents (Perched Zone)[2]	Ingestion	Ground Water	3.3E-4[4]	8.9E-4
	Ingestion	Soil	4.0E-8	6.3E-8
	Dermal	Soil	2.1E-7	3.3E-7
	Total[3]		3.3E-4	8.9E-4
Adult Residents (Regional Zone)[2]	Ingestion	Ground Water	6.7E-5	1.0E-4
	Ingestion	Soil	4.0E-8	6.3E-8
	Dermal	Soil	2.1E-7	3.3E-7
	Total[3]		6.7E-5	1.0E-4
Adult Worker (Onsite Perched Zone)[2]	Ingestion	Ground Water	1.1E-4	2.9E-4
	Ingestion	Soil	3.1E-8	4.9E-8
	Dermal	Soil	5.2E-7	8.1E-7
	Total[3]		1.1E-4	2.9E-4
Adult Worker (Onsite Regional Zone)[2]	Ingestion	Ground Water	2.3E-5	3.3E-5
	Ingestion	Soil	3.1E-8	4.9E-8
	Dermal	Soil	5.2E-7	8.1E-7
	Total[3]		2.3E-5	3.4E-5
Fish Hatchery Worker	Inhalation	Air	--[5]	2.5E-7

1 Maximally Exposed Individual (based on upper-bound concentrations).
2 Based on a hypothetical drinking water well in the perched or regional zones.
3 All routes, media.
4 $E\text{-}n = 10^{-n}$
5 Not Calculated.

Table 3

Summary of Estimated Noncarcinogenic Risk at Watkins-Johnson Site (Maximally Exposed Individual)[1]

Exposed Population	Route	Medium	Subchronic	Chronic
Adult Residents (Well in Perched Zone)[2]	Ingestion	Ground Water	0.036	0.249
	Ingestion	Soil	0.000	0.000
	Dermal	Soil	0.001	0.001
	Total[3]		0.039	0.252
Child Residents (Well in Perched Zone)	Ingestion	Ground Water	0.063	0.435
	Ingestion	Soil	0.009	0.011
	Dermal	Soil	0.006	0.006
	Total		0.078	0.452
Adult Worker (Well in Perched Zone)	Ingestion	Ground Water	0.018	0.134
	Ingestion	Soil	0.001	0.002
	Dermal	Soil	0.002	0.002
	Total		0.021	0.138
Adult Residents (Well in Regional Zone)[4]	Ingestion	Ground Water	0.041	0.245
	Ingestion	Soil	0.002	0.002
	Dermal	Soil	0.001	0.001
	Total		0.044	0.248
Child Residents (Wel in Regional Zone)	Ingestion	Ground Water	0.072	0.428
	Ingestion	Soil	0.009	0.011
	Dermal	Soil	0.006	0.006
	Total		0.087	0.445
Adult Worker (Well in Regional Zone)	Ingestion	Ground Water	0.021	0.149
	Ingestion	Soil	0.001	0.002
	Dermal	Soil	0.002	0.002
	Total		0.024	0.153

1 Based on the upper-bound concentration estimates.
2 Based on a hypothetical drinking water well in the perched zone.
3 All routes, media.
4 Based on a hypothetical drinking water well in the regional zone.

TABLE 4

REMEDIAL ALTERNATIVES AND COSTS
WATKINS-JOHNSON SUPERFUND SITE

COMPONENTS	CAPITAL COST	ANNUAL O&M COST	PRESENT WORTH
Alternative 1: Gravity Drains Leachfields Groundwater Extraction GAC Adsorption Soil Vapor Extraction Capping and Grading On-Site Domestic/Industrial Use On-Site Perched Zone Recharge Off-Site Discharge to Bean Creek	$837,738	$167,820	$2,156,243
Alternative 2: Gravity Drains Leachfields Groundwater Extraction Air Stripping Soil Vapor Extraction Capping and Grading On-Site Domestic/Industrial Use On-Site Perched Zone Recharge Off-Site Discharge to Bean Creek	$611,938	$167,820	$1,930,443
Alternative 3: Gravity Drains Leachfields Groundwater Extraction UV Oxidation Soil Vapor Extraction Capping and Grading On-Site Domestic/Industrial Use On-Site Perched Zone Recharge Off-Site Discharge to Bean Creek	$703,938	$139,020	$1,796,171

Table 5

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOR THE WATKINS-JOHNSON SITE

Standard, Requirement, Criteria, or Limitation	Description
Federal:	
Safe Drinking Water Act	Use of MCLs and MCLGs as treatment standards for current or potential drinking water source. See Table 6.
State:	
Air Resources Act	Establishes allowable discharge standards for point sources within each air pollution control district, and Ambient air Quality Standards.
Hazardous Substances Account Act/Hazardous Substances Cleanup Bond Act	Establishes state authority to clean up hazardous substance releases and compensate person injured by hazardous substances; establishes state "Superfund".
California Safe Drinking Water Act	Regulations and standards for public water systems; sets Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) which are enforceable in California; requirements for water quality analyses and laboratories.
Porter-Cologne Water Quality Control Act	Establishes authority for State and Regional Water Boards to determine site-specific discharge requirements and to regulate disposal of waste to land.

Table 5 (continued)

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOR THE WATKINS-JOHNSON SITE

Standard, Requirement, Criteria, or Limitation	Description
Water Quality Objectives	Standards identified in the water Quality Control Plan Report of the Regional Water Quality Control Board used to set standards for NPDES permits.
State Water Resources Control Board's Nondegradation Policy	State Board's policy on maintaining the high quality of California's waters.
Hazardous Waste Control Laws	Regulations governing hazardous waste control; management and control of hazardous waste facilities; transportation; laboratories; classification of extremely hazardous, hazardous, and nonhazardous waste.
Fish and Game Regulations on Pollution	Prohibits water pollution with any substance or material deleterious to fish, plant life, or bird life.
Monterey Bay Unified Air Pollution Control District Rule 1000	Requires pretreatment of all ambient discharges (e.g., from an air stripping unit).

Table 6

FEDERAL AND STATE GROUNDWATER ARARS AND TREATMENT STANDARDS

WATKINS-JOHNSON SUPERFUND SITE

(expressed in milligrams per liter)

Chemical	Maximum Detection	Federal MCLG[1]	Federal MCL[1]	CA-DHS MCL	CA-DHS Action Level	DHS Applied Action Level	Treatment Standard
Organics							
Chloroform	0.007	---	0.100[3]	---	---	0.006	0.100
1,2-Dichlorobenzene	0.004	0.600[2]	0.600[2]	---	---	0.130	0.600
1,4-Dichlorobenzene*	0.008	0.075	0.075	0.005	---	---	0.005
1,1-Dichloroethane*	0.010	---	---	---	---	0.005	0.005 TBC
1,1-Dichloroethylene*	0.011	0.007	0.007	0.006	---	---	0.006
cis-1,2-dichloroethylene*	0.053	0.070[2]	0.070[2]	0.006	0.016	---	0.006
Methylene Chloride	---	0	0.005	---	0.040	---	0.005
Tetrachloroethylene*	0.029	0	0.005[2]	0.005	0.004	---	0.005
1,1,1-Trichloroethane	0.043	0.200	0.200	0.200	---	---	0.200
1,1,2-Trichloroethane	0.003	---	---	0.032	0.100	---	0.032
Trichloroethylene*	0.550	0	0.005	0.005	0.005	---	0.005
Vinyl Chloride*	0.006	0	0.002	0.0005	---	---	0.0005
Metals							
Arsenic	0.017	0.050[2]	0.050	---	---	---	0.050
Barium	0.140	5.000[2]	5.000[2]	1.000	---	---	1.000
Cadmium	0.0048	0.005[2]	0.005[2]	---	---	---	0.005
Chromium	0.023	0.050	0.050	0.050	---	---	0.050
Copper	0.027	1.300	1.300	---	---	---	1.300
Lead	0.001	0[2]	0.005[2]	---	---	---	0.005
Mercury	0.0002	0.002[2]	0.002[2]	---	---	---	0.002
Nickel	0.069	---	---	---	---	---	0.100[5] TBC
Silver*	0.061	---	0.050	0.050	---	---	0.050
Vanadium	0.013	---	---	---	---	---	---
Zinc	1.700	---	5.000[4]	---	---	---	5.000

NOTES:

* - Maximum detection exceeded the treatment goal.
1 - Safe Drinking Water Act (SDWA), 42 U.S.C. Section 300(f)
2 - Proposed value (CFR Vol. 54, No. 97, p. 22064, May 22, 1989).
3 - Drinking water quality standard for total trihalomethanes.
4 - Secondary Federal MCL.
5 - EPA Health Advisory.
6 - Proposed value, State of California.
--- No value available.

Table 7

Selected Remedy
Summary of Costs

Alternative [1]	Capital Costs	ANNUAL O & M	Net Worth
Perched Zone Drains	$55,285	$43,200	$394,693
Leachfields	$21,990	$3.060	$46,034
Groundwater Extraction	$389,160	$36,000	$672,000
GAC Treatment	$350,000	$60,000	$821,000
Soil Vapor Extraction	$13,800	$15,600	$136,364
Capping & Grading	$7,500	$9,960	$85,752
TOTAL COST	$837,738	$167,820	$2,156,243

NOTES:

1 - EPA ackowledges that specific engineering modifications may arise during the Remedial Design and Remedial Action phases to alter the specific alternatives and the associated costs presented here.

TABLE 8

WATKINS-JOHNSON WATER USE RATES

Fourth Quarter 1989

TOTAL GPM EXTRACTED	209		
TOTAL GPM REUSED ON-SITE	37	or	18%
TOTAL GPM REINJECTED*	15	or	7%
TOTAL GPM DISCHARGED TO CREEK	157	or	75%

* REINJECTING INTO ONE LEACHFIELD

FUTURE PROJECTED DATA

TOTAL GPM EXTRACTED	110		
TOTAL GPM REUSED ON-SITE	37	or	34%
TOTAL GPM REINJECTED*	45	or	42%
TOTAL GPM DISCHARGED TO CREEK	25	or	24%

* REINJECTING INTO THREE LEACHFIELDS 15 GPM

GPM = Gallons per Minute